Assessing the Feasibility of Using NASA Earth Observations to Monitor Trends in Runoff and Stormwater Discharge of the Biscayne Bay

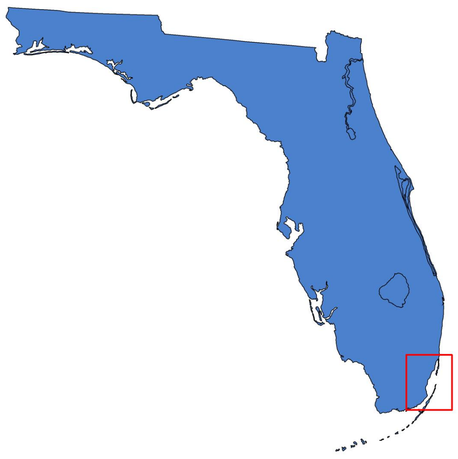
Abstract

Submerged Aquatic Vegetation (SAV) is an important component of coastal ecosystems, and is vulnerable to increased turbidity in the water column. It provides stability and protection to sediment deposits, and offers food and shelter to economically valuable species of marine life. Recent urban development and population growth in the Miami area have resulted in an increase in stormwater discharge connected to changing water quality in Biscayne Bay. The project used Earth observation data from a suite of sensors including Landsat 8 OLI, Landsat 7 ETM+, Landsat 5 TM, and Sentinel-2 MSI in conjunction with *in situ* water quality monitoring data. Turbidity, chlorophyll-a concentration, Normalized Difference Turbidity Index (NDTI), absorbance due to dissolved and non-algal detrital material (A_{DG}), and Total Suspended Matter (TSM) data were used to develop a tool to view both historic and current water quality parameters in Biscayne Bay. The results of this project will assist the City of Miami Beach Public Works Department in decision making and predicting future water quality trends in Biscayne Bay and the surrounding area.

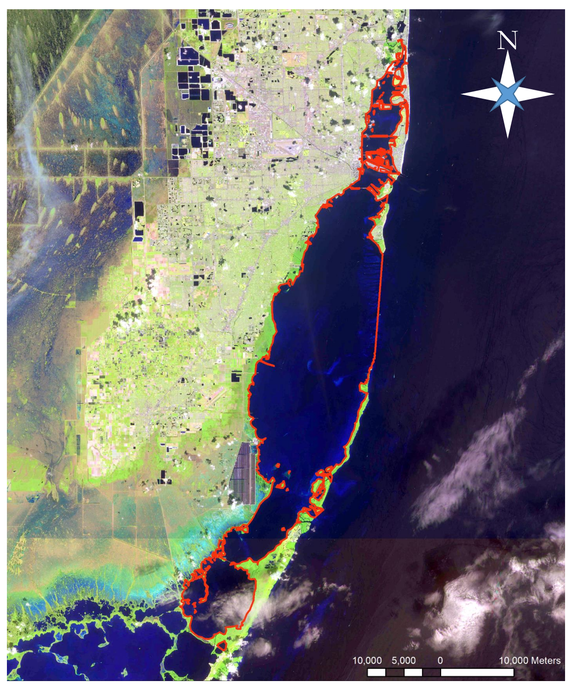
Objectives

- **Assess** feasibility of using NASA Earth observations for water quality monitoring in Biscayne Bay
- **Develop** correlations between *in situ* and remotely sensed data
- **Produce** annual water clarity maps
- **Generate** trend maps of chlorophyll-a concentration and turbidity

Study Area

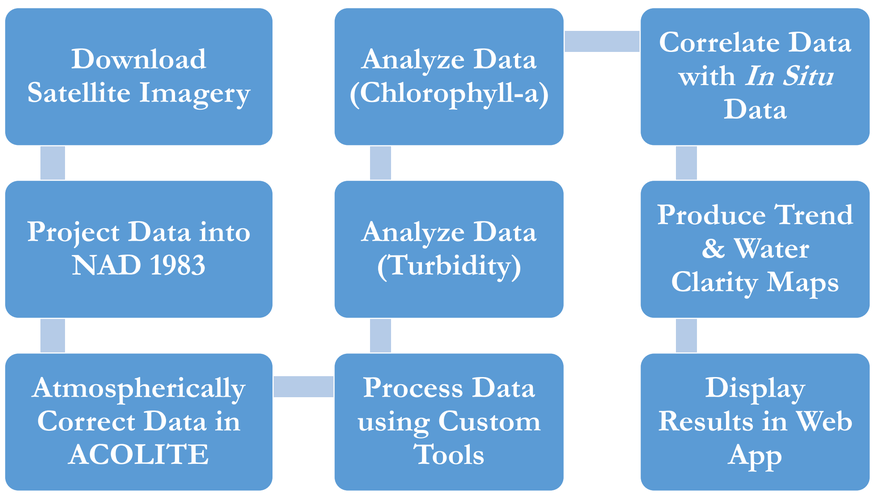


Outlined area enlarged



Biscayne Bay outlined in red

Methodology



Project Partners

City of Miami Beach, Public Works Department

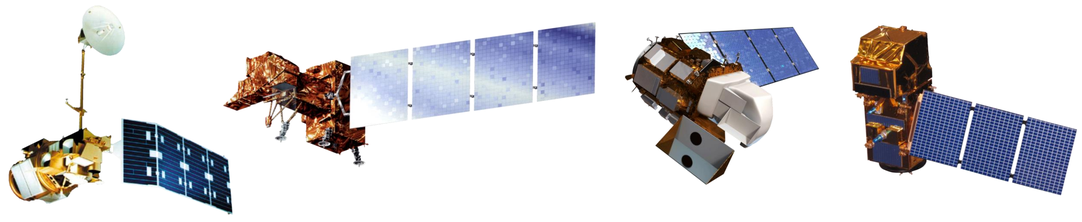
Team Members

Pamela Kanu
(Project Lead)

Danielle Quick

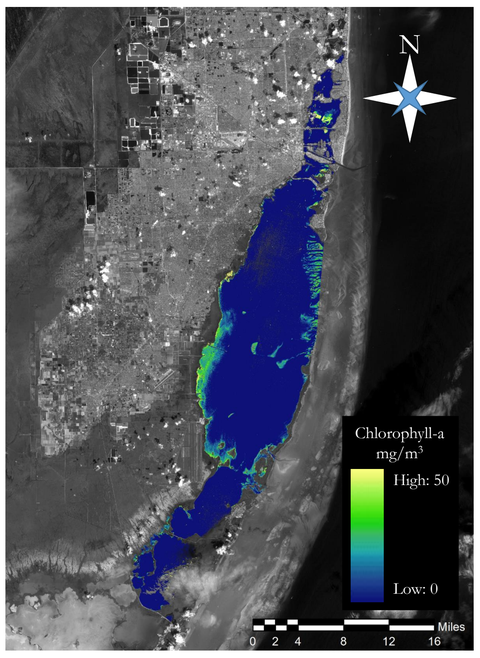
Randolph Colby

Earth Observations

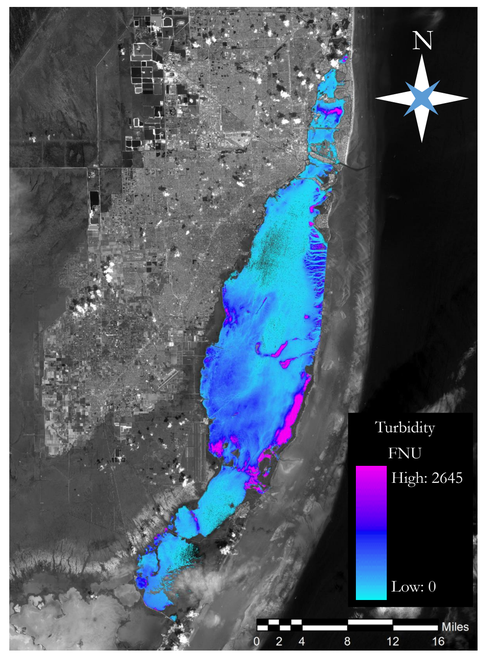


Landsat 5 TM | **Landsat 7** ETM+ | **Landsat 8** OLI | **Sentinel-2** MSI

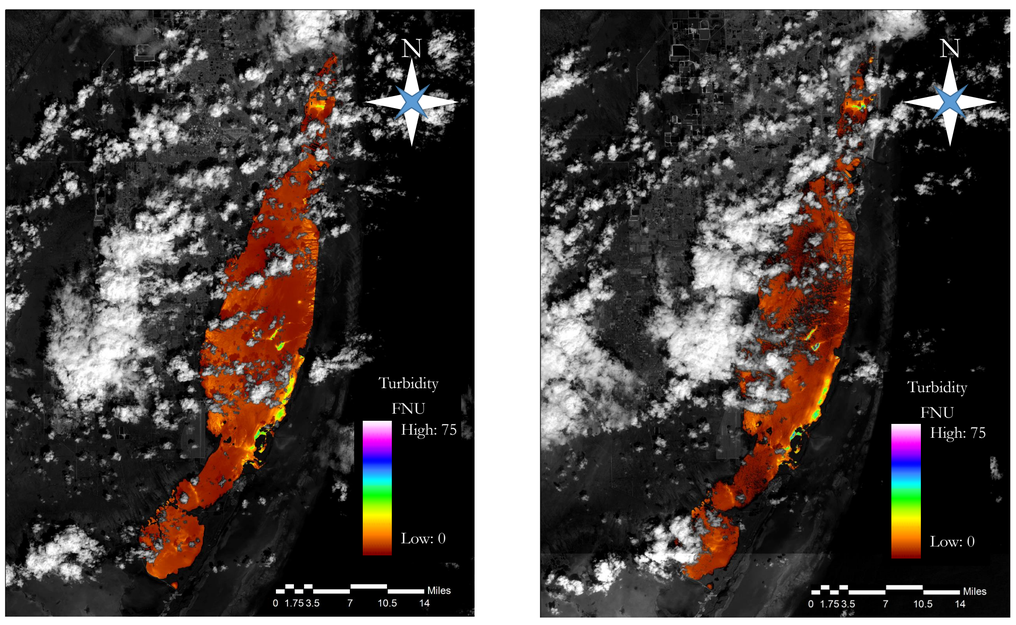
Results



ACOLITE-derived Chlorophyll-a concentration from Sentinel-2 MSI on 3/02/2016



ACOLITE-derived turbidity from Sentinel-2 MSI on 3/02/2016



ACOLITE-derived turbidity from Landsat 8 OLI (left) and Sentinel-2 MSI (right) on 10/04/2015. Turbidity from Landsat 8 was on average 0.06 FNU higher than that from Sentinel, with a standard deviation of 2.69.

Conclusions

- Strong correlations between *in situ* data and remotely sensed data were not found for turbidity metrics.
- *In situ* data sampling dates did not coincide with flyover dates for Sentinel-2, so correlations for chlorophyll-a could not be established.
- ACOLITE is a powerful tool for processing imagery over water using a collection of reputable algorithms in remotely sensed systems.
- ACOLITE turbidity products from Landsat 8 OLI and Sentinel-2 MSI are statistically close enough to be used interchangeably.

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Miami Beach Water Resources

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